

NETWORK TOPOLOGY

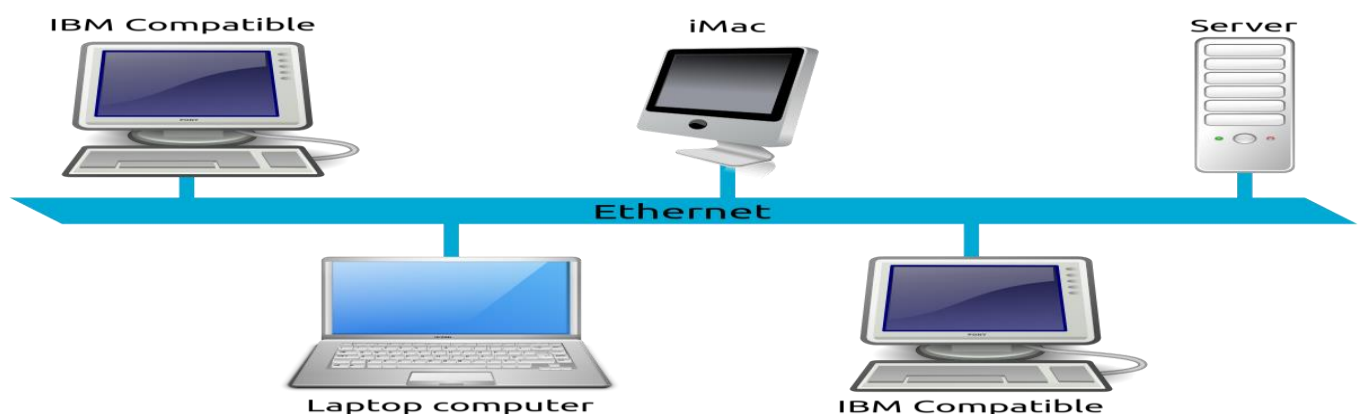
Network Topology is the arrangement of connected computers, cables and other hardware components on the network.

Types of Network Topology

The physical topology is the layout of the cables and network devices while logical topology is the method of communication of the network devices. The various network topologies are:

1. Bus Topology
2. Ring Topology
3. Star Topology
4. Mesh Topology
5. Tree Topology
6. Hybrid Topology
7. Point to Point Topology

1. **Bus Topology** is a network type in which every computer and network device is connected to a single cable. It is bi-directional. It has terminators at both ends, it is called **linear bus topology**. The cable is normally called **Backbone**.



Bus Topology

Features of Bus Topology

- It transmits data only in one direction.
- Every device is connected to a single cable.

Advantages of Bus Topology

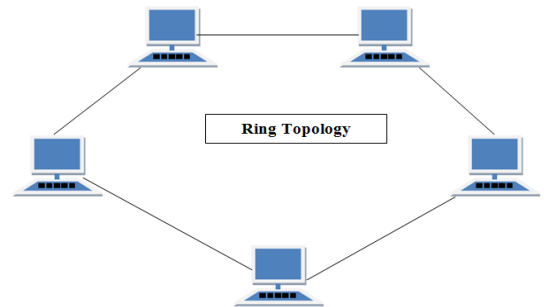
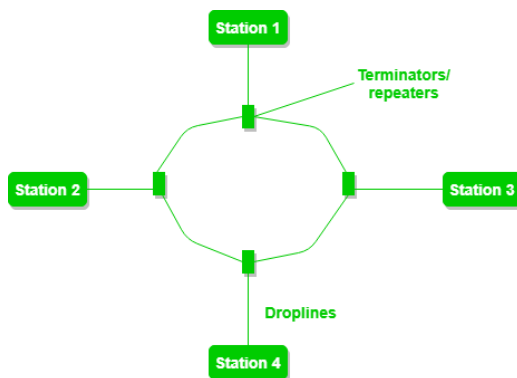
- It is cheaper because it requires less cable length than star topology.
- It is easier to connect to a computer or peripheral to a linear bus.
- The failure of one workstation does not affect the network.
- It is used in small networks.
- It is easy to understand.
- Easy to expand joining two cables together.

Disadvantages of bus topology

- It can be difficult to identify the problems if the whole network goes down.
- It can be hard to troubleshoot individual device issues.
- Bus topology is not great for large networks.
- Terminators are required for both ends of the main cable.
- Additional devices slow the network down.
- If a main cable is damaged, the network fails or splits into two.
- A minimum distance must be set to avoid interference.
- If the bus network is heavily used ie sharing the same communication link, the flow of data will be slow unless the bandwidth of the network is high.

A common example of bus topology is the Ethernet LAN, where all devices are connected to a single coaxial cable or twisted pair cable. This topology is also used in cable television networks.

2. **Ring Topology:** in this type of topology all network devices or nodes are connected together in a ring form that is continuous loop. Repeaters are used in this topology that has large number of nodes. **Token passing is used.** A **Token** is a frame that circulates around the network. example IBM Token Ring Network.



Ring Topology

Features of ring topology

- A number of repeaters are used.
- The data flow is in a unidirectional and bidirectional path. LAN and MAN Networks are used in a ring topology.
- Nodes act like a repeater in the network.
- Data flow is in proper order ie sequential order.

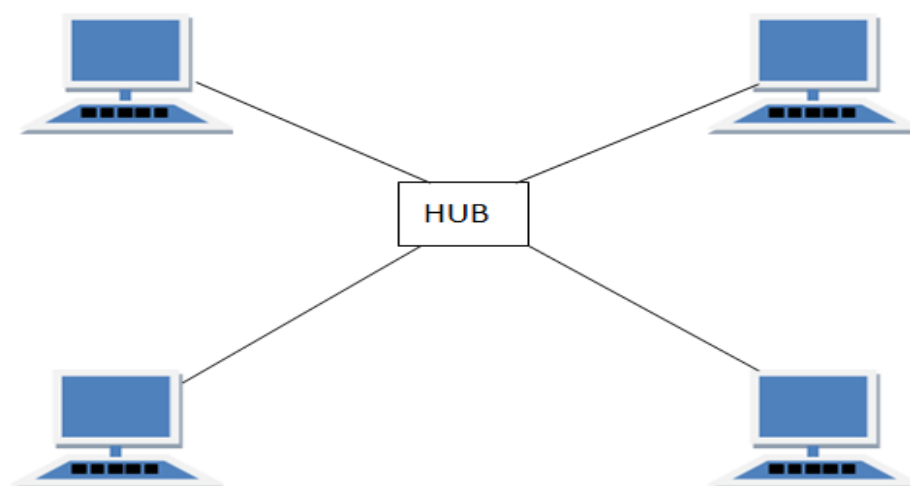
Advantages of a ring topology

- All data flows in one direction, reducing the chance of packet collisions.
- A network server is not needed to control network connectivity between each workstation.
- Data can transfer between workstations at high speeds.
- Additional workstations can be added without impacting performance of the network.

Disadvantages of a ring topology

- All data being transferred over the network must pass through each workstation on the network, which can make it slower than a [star topology](#).
- The entire network will be impacted if one workstation shuts down.
- The hardware needed to connect each workstation to the network is more expensive than Ethernet cards and hubs/switches.

3. **Star Topology:** In [Star Topology](#), all the devices are connected to a single hub through a cable. This hub is the central node and all other nodes are connected to the central node, it acts as a server. Coaxial cables or RJ-45 cables are used to connect the computers. Example of star topology is ARCNET.



Star Topology

Features of Star Topology

1. Every node has its own dedicated connection to the hub.
2. Hub acts as a repeater for dataflow.

3. It can be used with twisted pair, optical fiber or coaxial cable.

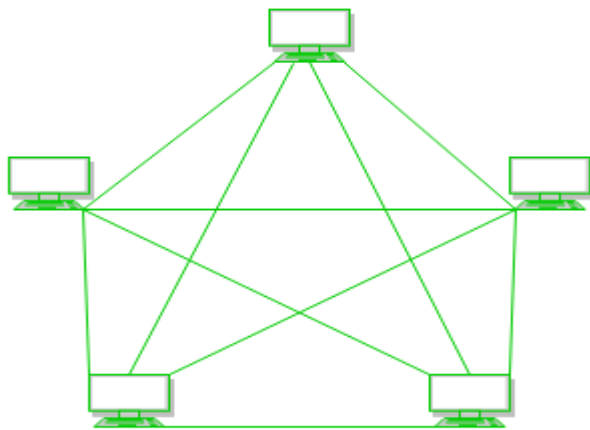
Advantages of Star Topology

- Easy to troubleshoot.
- Easy to set up and modify.
- Hub can be upgraded easily.
- If one node fails, others can still work smoothly except if the central point fails.
- It is Robust. If one link fails only that link will affect and not other than that.
- Fast performance with few nodes and low network traffic.
- Star topology is cost-effective as it uses inexpensive coaxial cable.

Disadvantages of Star Topology

- It is expensive to use because it requires more cable length than bus topology.
- If the hub fails then the whole network is stopped.
- Performance is dependent on the capacity of the Hub.

4. Mesh Topology: this is a point-to-point connection where every device is connected to another device via a particular channel. In Mesh Topology, the protocols used are AHCP (Ad Hoc Configuration Protocols), DHCP (Dynamic Host Configuration Protocol), etc. Mesh has $n(n-1)/2$ physical channels to link n devices. This topology is mostly used in military communication systems and aircraft navigation systems. There are two techniques to transmit data over the mesh topology they are **routing** and **flooding**.



Mesh topology

Features

1. It is fully connected.
2. It is very strong.
3. It is not flexible

Advantages

1. Each connection can carry it's own data load.
2. It is robust(strong).
3. Troubleshooting is easy.
4. It provides security and privacy.
5. Expansion and modification are easy.
6. Communication is very fast between the nodes.

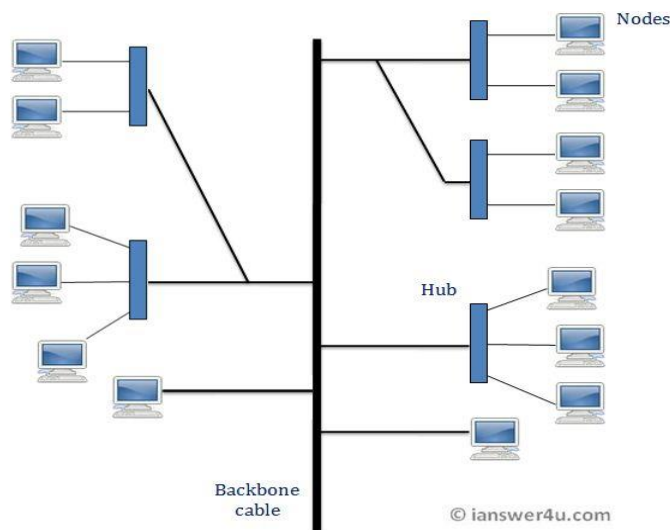
Disadvantages

1. Installation and configuration are difficult.
2. Cabling cost is more.
3. Bulk wiring is required.
4. There are high chances of redundancy in many network connections.

5. Tree Topology:

This topology is a combination of different topologies. It is a variation of the Star topology. This topology has a hierarchical flow of data, it can also be called hierarchical topology or expanded star topology. In [Tree Topology](#), protocols like DHCP and SAC (Standard Automatic Configuration) are used. A common example of a tree topology is the hierarchy in a large organization. At the top of the tree is the CEO, who is connected to the different departments or divisions (child nodes) of the company. Each department has its own hierarchy, with managers

overseeing different teams (grandchild nodes). The team members (leaf nodes) are at the bottom of the hierarchy, connected to their respective managers and departments.



Tree Topology

Features of Tree Topology

- New nodes (or devices) can be added to the leaf nodes, without affecting the communication of other devices on the network.
- It is highly scalable, as the hierarchy grows, the more nodes can be added to the leaf nodes.
- Highly secure topology as there is only one connection between the two connected nodes.

Advantages of Tree Topology

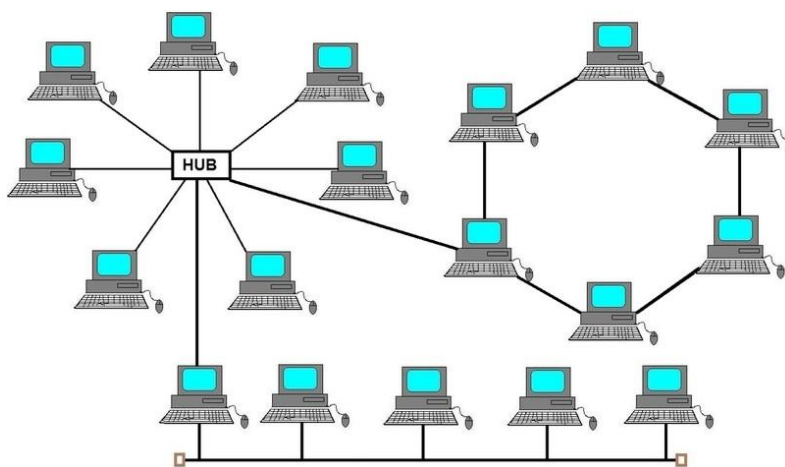
- It allows more devices to be attached to a single central hub thus it decreases the distance that is traveled by the signal to come to the devices.
- It allows the network to get isolated and also prioritize from different computers.
- **New devices can be added to the existing network.**
- **Error detection and error correction** are very easy in a tree topology.

Disadvantages of Tree Topology

- If the central hub gets fails the entire system fails.
- The cost is high because of the cabling.
- If new devices are added, it becomes difficult to reconfigure.

- More cables are used.
- Scalability(ability to adjust to changes) depends on the type of cable used.

6. **Hybrid Topology:** this is the combination of two or more topologies. For example, if in an office in one department ring topology is used and in another star topology is used, connecting these topologies will result in Hybrid topology (ring and star) topologies. Examples of hybrid topologies star bus, star ring , star ring bus etc.



Hybrid topology

Features of hybrid topology

1. Easy to identify faulty node in the network and it can be removed as well as it has ability to repair their nodes over the network.
2. It can support huge networks and comfortable to transfer data in between the different types of network.
3. It helps to enhance the performance over all networks due to its efficient and effective design layout.
4. It is extremely flexible and reliable.
5. It is easily scalable as Hybrid networks are built in a fashion which enables easy integration of new hardware components.

Advantages of hybrid topology

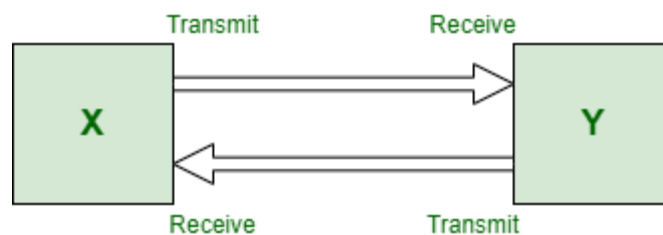
- It is reliable.

- Easy to trouble shoot.
- It is effective.
- Scalable as size can be increased easily.
- It is flexible.

Disadvantages of hybrid topology

- It is very complex.
- Very costly.

7. **Point-to-Point Topology** is a type of topology that works on the functionality of the sender and receiver without any middleman. It is the simplest communication between two nodes, in which one is the sender and the other one is the receiver. Point-to-Point provides high bandwidth.



Point To Point Topology

Features Point to Point topology

- High bandwidth
- Easy replacement of node
- Connection speed is fast
- Troubleshooting is easy
- Maintenance is easy

Advantages Point to Point topology

- It is fast, simple, and convenient way to connect 2 devices together.
- Very easy to maintain, if a wire has a problem you can replace it within a few seconds.
- Maximum utilization of the underlying connecting link bandwidth.
- This is the most simple topology as compared to any other network topology type.
- Least delay in communication as compared to any other network connection type.
- Low-cost option when you have only two nodes to connect.

Disadvantages of Point-to-Point topology

- The network performance depends on a single link only. If the common link is down, the entire network stop working.
- Because of the need for a direct connection, topology can not be expanded to a large area. E.g. if there is a multistorey building, two computers may be far apart.
- The failure of a single node in the network can cause the entire network to fail.
- Troubleshooting is difficult in this topology.
- The addition of stations in between or the removal of stations can disturb the whole topology.